MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210 & TERM ID 2215)

PCL0016 – CALCULUS

(ALL Sections/Groups)

18 FEBRUARY 2023
9:00 A.M - 11:00 A.M.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages including cover page with FOUR questions.

2. Attempt **ALL FOUR** questions and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1 (25 marks)

(a) Evaluate the following limits without using L'Hôpital's Rule.

(i) $\lim_{x\to -2} x^5 - 3x^3 + 2x + 7$ [2 marks]

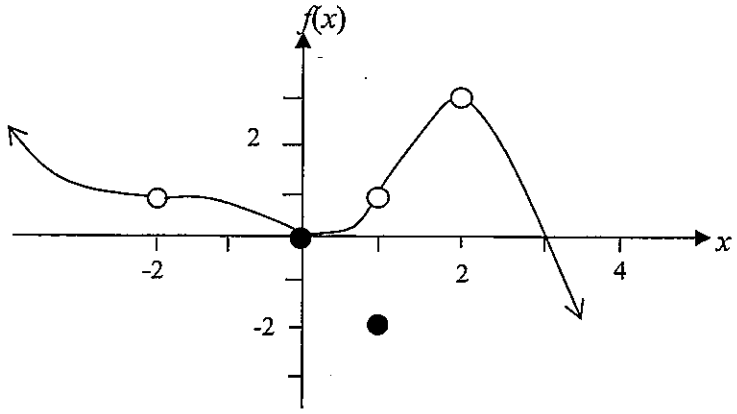
(ii) $\lim_{x\to -7} \dfrac{x^2 + 18x + 77}{x^2 + 5x - 14}$. [3 marks]

(iii) $\lim_{x\to \infty} \dfrac{x^3 - x^2 + 1}{x^4 + 2x^2 - 5}$. [3 marks]

(iv) $\lim_{x\to 0} \dfrac{\tan x}{x\cos x}$. [3 marks]

(v) $\lim_{x\to 5} \dfrac{\sqrt{x+4} - 3}{x - 5}$ [3 marks]

(b) The graph of a function $f(x)$ is given below.



Find the following limits:

(i) $\lim_{x\to -2} f(x)$ [1 mark]

(ii) $\lim_{x\to 0} f(x)$ [1 mark]

(iii) $\lim_{x\to 1} f(x)$ [1 mark]

(iv) $\lim_{x\to \infty} f(x)$ [1 mark]

Continued.....

(v) $f(1)+\lim_{x\to 2} f(x)$ [2 marks]

(c) Is the function $f(x)$ in part (b) continuous at $x=2$ and at $x=3$? Justify your answers by using the conditions for continuity at a point. [5 marks]

Question 2 (25 marks)

(a) Evaluate $\frac{dy}{dx}$ for the following functions:

(i) $xy+\sin y=3$ by using implicit differentiation. [4 marks]

(ii) $y=\frac{(x+2)^3(x-1)}{(x+4)^5}$ by using logarithmic differentiation. [6 marks]

(b) Evaluate the following integrals:

(i) $\int_0^1 4x^3+3x^2 6\ dx+\int_1^2 e^x+\frac{1}{x^2}\ dx$ [5 marks]

(ii) $\int 6x^2\sqrt{2x^3-3}\ dx$ by using integration by substitution. [4 marks]

(iii) $\int \frac{x+2}{(x+3)(x+5)}dx$ by using partial fraction decomposition. [6 marks]

Question 3 (25 marks)

(a) A region is bounded by $y=x^2$ and $y=2x$. Sketch the bounded region with the intersection points and find the following:

(i) Area of the bounded region. [7 marks]

(ii) By using the washer method, find the volume of the solid generated by revolving the shaded region about the x - axis. [5 marks]

(iii) By using the cylindrical shell method, find the volume of the solid generated by revolving the shaded region about the y - axis. [5 marks]

(b) A force of x^3+4x newton is applied to a body that is located x meters from the origin. How much work is done in moving the body from $x=2$ to $x=4$ meters? [4 marks]

Continued.....

(c) A car is moving with a velocity with the time t seconds, $v(t)=4t^3-2t^2+6$. Find the average velocity of the car from $t=2$ to $t=3$ seconds. [4 marks]

Question 4 (25 marks)

(a) Find the solutions of the following second order differential equations. Hence, determine the type of the roots for each of the solution.

(i) $y''+2y'-8y=0$. [5 marks]

(ii) $y''-10y'+25y=0$. [5 marks]

(b) Solve the following differential equations by separation of variables method.

(i) $(x+1)\frac{dy}{dx}=y$. [4 marks]

(ii) $\frac{dy}{dx}=xy, \quad y(0)=2$. [5 marks]

(b) Solve the linear differential equation $\frac{dy}{dx}+\frac{1}{x}\cdot y=3-\frac{1}{x^2}$. [6 marks]

End of Paper